Fact Sheet

Regulating Canada's Geological Repositories

February 2011

The mandate of the Canadian Nuclear Safety Commission (CNSC) is to protect the health, safety and security of Canadians and the environment and to implement Canada's international commitments on the peaceful use of nuclear energy. The CNSC regulates the licensing, monitoring and inspection of nuclear facilities in Canada, including radioactive waste management facilities. All radioactive waste in Canada, including used nuclear fuel, is held in safe, secure, environmentally-sound interim storage facilities.

As the Canadian nuclear regulator, the CNSC is responsible for licensing geological repositories intended to provide for long-term management of radioactive wastes. A geological repository is constructed underground, usually at a depth of several hundred metres or more below the surface in a stable rock formation.

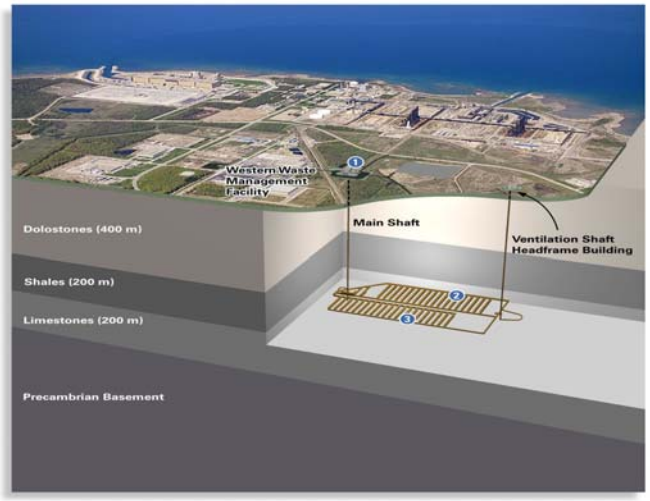
Currently in Canada, there are two long-term radioactive waste management initiatives underway that may result in geological repositories.

Quick facts

- The Government of Canada's 1996 *Policy Framework for Radioactive Waste* provides the national context for radioactive waste management and a set of principles to ensure that this management of radioactive waste is carried out in a safe, environmentally sound manner.
- Radioactive waste is defined as any material (liquid, gaseous or solid) that contains a radioactive nuclear substance that the owner has no foreseen use for and that is determined to be a waste product.
- The Government of Canada and the nuclear industry are developing solutions for long-term radioactive waste management that protects the health, safety and security of persons and the environment.

Ontario Power Generation's proposed Deep Geologic Repository

Ontario Power Generation (OPG) is proposing the construction of a deep rock vault in clay-rich limestone, hundreds of metres below ground. This Deep Geologic Repository (DGR) will be a long-term management facility for OPG's low- and intermediate-level radioactive wastes. The proposed location for the DGR is the Bruce nuclear site in Tiverton, Ontario (Municipality of Kincardine). In June 2007, the Minister of the Environment referred the DGR project environmental assessment to a review panel and it is expected that the appointment of the joint review panel (JRP) will be announced in 2011. The JRP will assess the environmental assessment and the first stages of licensing. More information about this project is available at www.opg.com.



Conceptual design of a Deep Geologic Repository (DGR)

Source: Ontario Power Generation

The Nuclear Waste Management Organization's plan for a geological repository

Established in 2002 to assume responsibility for the long-term management of Canada's used nuclear fuel, the Nuclear Waste Management Organization (NWMO) consulted with Canadians on a process for identifying an informed and willing community to host a geological

repository for Canada's used nuclear fuel. After a comprehensive three-year study and public engagement, the Government of Canada selected the NWMO recommended Adaptive Phased Management (APM) approach. The APM is a phased approach for the safe and secure long-term management of used nuclear fuel.

At the end of 2009, the NWMO completed its public engagement activities to design the APM siting process and is now implementing this community-driven process. Interested communities can learn more at www.nwmo.ca.

What are the licensing steps for a geological repository?

The CNSC uses a comprehensive licensing system that covers the entire lifecycle of a geological repository from site preparation to construction, operation, decommissioning (closure) and, finally, post-closure. This approach requires a separate licence at each phase, although the site preparation and site construction licences can be combined.

The CNSC's regulatory philosophy for radioactive waste stems from the *Nuclear Safety and Control Act* (NSCA) and is articulated in CNSC documents P-299, *Regulatory Fundamentals*, P-290, *Managing Radioactive Waste*, and G-320, *Assessing the Long Term Safety of Radioactive Waste Management*.

Did you know?

- Within the current Government of Canada policy, waste producers and owners are responsible for the funding, management and operation of interim and long-term waste management facilities, so the next generation of Canadians are not burdened with the cost. This type of responsibility is also known as "the polluter pays principle". One exception is historic waste, for which the Government of Canada assumes responsibility.
- Sweden, Finland, France and South Korea also have initiatives underway to develop geological repositories for used nuclear fuel.
- Germany has issued a licence to construct a geological repository to store low- and intermediate-level radioactive waste.
- Canada's nuclear power program has produced over two million used fuel bundles over the past half century. If these bundles were stacked end-to-end, they would fit into a space the size of six hockey rinks stacked to the top of the boards.

The CNSC can make a licensing decision on a geological repository only after the completion of the environmental assessment (EA) process. EAs are used to predict, evaluate and manage the environmental impacts of a proposed project and to determine whether these impacts can be mitigated. EAs examine elements such as air quality, long-term environmental impacts, human health, use of land and resources and Aboriginal interest, physical and cultural heritage.

In a licence application, an applicant must include information associated with a facility's operation and future decommissioning, including financial guarantees for each phase. Financial guarantees ensure the licensees have sufficient funds to cover the cost of decommissioning work resulting from the licensed activity. The outcome of the licensing process feeds back into a compliance program that verifies that the licensee fulfills the regulatory requirements.

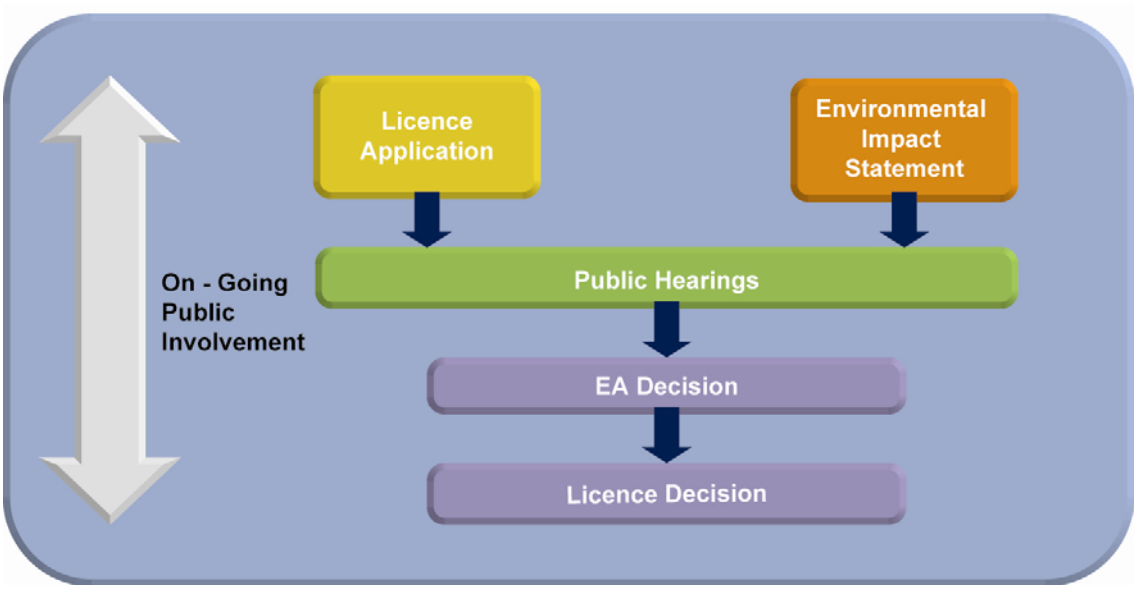
The public has opportunities to participate and be heard throughout the EA and licensing processes (see Figure 1).

Joint review panels

If a proposed project is likely to have adverse environmental effects, if the effects are uncertain, or if public concern warrants it, the CNSC may recommend to the Minister of the Environment that a joint review panel be appointed to review and assess the project in an impartial and objective manner. Review panels consist of a group of experts selected on the basis of their knowledge and expertise. A review panel conducts the EA and submits its recommendations to the Minister of the Environment and to the responsible authorities (i.e. CNSC) for their consideration in subsequent licence decision-making. This is the process currently underway for OPG's DGR.

Review panels encourage an open discussion and exchange of views. They also inform and involve large numbers of interested groups and members of the public by allowing individuals to present information, concerns and recommendations during public consultations and at public hearings. A panel allows the proponent to present the project to the public and explain the anticipated environmental effects, and provides opportunities for the public to hear the views of government experts about the project.

Figure 1: The licensing and EA processes allow for ongoing public involvement



How can the public participate in the licensing of geological repositories?

The CNSC is committed to operating with a high level of transparency. Engaging stakeholders, including Aboriginal peoples, early and in advance of submissions for proposed new nuclear projects through a variety of consultation opportunities ensures effective dialogue and information sharing.

Once an application has been received, the EA and licensing processes begin. Both processes provide opportunities for public participation. The CNSC also has a duty to consult with Aboriginal communities when Aboriginal rights or interests could be impacted, and recognizes the importance of consulting and building relationships with Canada's Aboriginal peoples.

The Commission Tribunal also holds formal public hearings. Members of the public are welcome to observe the Tribunal's public hearings, or to actively participate as intervenors. The Tribunal may also accommodate intervenor participation in its proceedings by teleconference or videoconference.

Getting involved

- To formally participate in public hearings, interventions can be made in either of Canada's official languages and may be written, or written and oral.
- The CNSC webcasts its public hearings and meetings, and keeps an archive of previous webcasts at nuclearsafety.gc.ca.
- Public hearing agendas are available on our Web site before each public hearing.

What is the technical assessment process for licence applications?

CNSC experts and technical specialists conduct a thorough technical assessment of information submitted by applicants in support of the applications. This assessment is usually carried out with input from other federal, provincial and territorial government departments and agencies responsible for regulating health and safety, environmental protection, emergency preparedness and the transportation of dangerous goods.

The technical assessment focuses on determining whether the proposed design and safety analysis, along with other required information, comply with regulatory requirements. This review requires rigorous engineering and scientific analyses, taking into consideration the CNSC's experience and knowledge of best practices in radioactive waste management from existing facilities in Canada and around the world.

The information required in licence applications would include evaluation of safety assessment and development of the safety case by qualified staff in several phases:

- Site preparation
- Construction
- Operation
- Decommissioning (closure)
- Post-closure

Information in licence applications depending on the phase may also include an evaluation by qualified staff of public information programs, packaging and transportation, safeguards, waste management, emergency preparedness, environmental protection, occupational health and safety, radiation protection, physical design, operations and management systems.

Similar to other nuclear facilities, the licensing of geological repositories in Canada must address the requirements and regulations made under the NSCA — the cornerstone of the CNSC regulatory framework. Licensing must also address the CNSC's commitment to international standards and best practices, including those of the International Atomic Energy Agency (IAEA).

Canadians can be assured that any geological repository built in Canada will meet the highest standards for health, safety, security and environmental protection.

Did you know?

- The CNSC's commitment to international standards and best practices assures that the management of radioactive waste in Canada meets the highest standards for health, safety, security and environmental protection.
- Through participation in international forums, the CNSC stays informed of best practices in radioactive waste management.
- The CNSC ensures that proper security measures are in place for nuclear facilities and that nuclear sector workers' health is protected.

What kind of research does the CNSC conduct on geological repositories?

Since 1978, the CNSC has been involved in independent research and assessment, including international collaboration, on the safe long-term management of used nuclear fuel in geological repositories. In particular, these activities looked at the Canadian Shield's granitic rock as suitable rock formation for this type of repository.

At this time, OPG's DGR project for the long-term management of low- and intermediate-level wastes is assessing sedimentary rock formation for the facility. To provide sufficient independent knowledge for assessing future proposals involving geological repositories, the CNSC is expanding its technical expertise from granitic rock to include knowledge and understanding of geological disposal in sedimentary rock.

The CNSC is conducting a three-year program to evaluate long-term (up to a million years) safety issues related to the disposal of radioactive waste and used nuclear fuel in sedimentary rock. This program consists of independent scientific research conducted by CNSC staff in collaboration with national and international institutions. It also includes monitoring and review of state-of-the-art scientific advancements, and participation in international forums to exchange information and knowledge related to geological repositories.

How does the CNSC verify compliance at radioactive waste management facilities?

Once the CNSC issues a licence, the licensee must comply with the requirements of the NSCA and its associated regulations, as well as the specific conditions of the licence. The CNSC has compliance programs for all regulated nuclear facilities in Canada, including any future geological repositories, to ensure these requirements are respected. At existing radioactive waste management facilities, the CNSC verifies compliance by reviewing programs and reports submitted by

the licensee and by inspecting the licensee's facility and activities. Licensees are required to submit environmental and radiation monitoring results, unusual-occurrence reports and annual performance reports.

CNSC staff conduct regular site inspections of radioactive waste management facilities to make sure that radioactive waste containment systems remain appropriate and safe and to ensure that licensees' radioactive waste-related activities and inventory statistics are properly reported. CNSC inspectors also monitor and take samples of air quality and liquid effluent to verify that licensee facilities are operating within established limits.

In conjunction with the CNSC, the IAEA monitors Canada's used nuclear fuel storage facilities to verify that these facilities comply with Canada's obligations under the Canada/IAEA Safeguards Agreements stemming from the Treaty on the Non-Proliferation of Nuclear Weapons. These agreements give the IAEA the right and obligation to monitor Canada's nuclear-related activities and to verify nuclear materials inventories and flows.

The CNSC works with licensees to inform them about regulatory expectations and licence requirements. When necessary, the CNSC uses a graded series of enforcement actions to ensure compliance and to protect workers, the public and the environment, and to respect Canada's international agreements.

How does the CNSC ensure that radioactive waste is transported safely to waste management facilities?

The responsibility to regulate the safe transport of nuclear substances, including radioactive waste, is jointly shared between the CNSC and Transport Canada. Transport Canada's *Transportation of Dangerous Goods* (TDG) *Regulations* deal with the transport of all classes of dangerous goods, while the CNSC's *Packaging and Transport of Nuclear Substances* (PTNS) *Regulations* are primarily concerned with health, safety and security of the public, and protection of the environment related to the special characteristics of radioactive material. Both the TDG and PTNS Regulations apply to all persons who handle, offer for transport, transport or receive nuclear substances.

The basic philosophy that has guided the development of the CNSC Regulations is that safety is incorporated in the design of the transport package. Package designs are combined with additional regulatory controls including labeling, placarding, quality assurance and maintenance records, and allow for radioactive material to be carried safely in all modes of transport such as road, rail, air and sea transportation.

All nuclear substances are transported in packages that are selected based on the nature, form and quantity or activity of the substance. There are general design requirements that apply to all package types to ensure that they can be handled safely and easily, secured properly, and are able to withstand routine conditions of transport.

What are the CNSC's international responsibilities with regard to radioactive waste?

As long-term strategies and solutions for the safe management of radioactive waste evolve, the Government of Canada must continue to demonstrate how it meets its international obligations under the terms of the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*.

This international agreement aims to ensure worldwide safe management of used nuclear fuel and radioactive waste – an objective that is achieved through the peer-review of a country's radioactive waste management programs. Every three years, the Government of Canada issues the *Canadian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.* The CNSC coordinates the preparation of this national report with other Government of Canada departments and the nuclear industry to demonstrate how Canada is meeting its international obligations and to report on its radioactive waste inventories to the IAEA.

Why does Canada have radioactive waste management facilities?

Licensed activities produce many types of radioactive waste, such as uranium mill tailings, medical isotope waste, used nuclear fuel, and cleaning material contaminated with low levels of nuclear substances – each presents its own level of hazard and requires safe storage facilities. Since all nuclear substances associated with licensed activities will eventually become radioactive waste, the safe long-term management of that radioactive waste is considered during the review

process for any licensed activity. One of the CNSC's principles is that the licensee must minimize the generation of radioactive waste as much as possible – this can be achieved with the implementation of design measures, operating procedures and decommissioning practices.

Statistics on Canada's waste inventories are gathered by Natural Resources Canada (NRCan). On its behalf, every five years the Low-Level Radioactive Waste Management Office (LLRWMO) issues the *Inventory of Radioactive Waste in Canada* report, which profiles waste management statistics based on Canada's four waste categories: used nuclear fuel (high-level waste), low- and intermediate-level radioactive waste, and uranium mining and milling waste. Inventory data is reported to the IAEA for submission in the Radioactive Waste Management Database. This database tracks low- and intermediate-level radioactive waste worldwide. NRCan also provides this data to *Canada's National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*.

Figure 2: The radioactive waste inventories for used nuclear fuel and low- and intermediate-level radioactive waste in Canada, as reported in 2007.

Waste Data to 2007

WASTE CATEGORY	WASTE PRODUCED IN 2007	WASTE INVENTORY TO THE END OF 2007
Nuclear Fuel Waste	311 m^3	8,130 m^3
Intermediate-Level Radioactive Waste	890 m^3	30,350 m^3
Low-Level Radioactive Waste	4,560 m^3	2.33 million m^3

Source: *Inventory of Radioactive Waste in Canada*, LLRWMO, March 2009

Figure 3: The waste inventory projections from 2008 to 2050

Waste Inventory Projections to 2008 and 2050

WASTE CATEGORY	WASTE INVENTORY TO END OF 2008	WASTE INVENTORY TO END OF 2050
Nuclear Fuel Waste	8,500 m^3	21,300 m^3
Intermediate-Level Radioactive Waste	31,000 m^3	79,000 m^3
Low-Level Radioactive Waste	2.33 million m^3	2.57 million m^3

Source: *Inventory of Radioactive Waste in Canada*, LLRWMO, March 2009

For more information:

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